In the Claims

1. (Original) An MRI apparatus comprising:

a magnetic resonance imaging (MRI) system having a plurality of gradient coils positioned about a bore of a magnet to impress a polarizing magnetic field and an RF transceiver system and an RF switch controlled by a pulse module to transmit RF signals to an RF coil assembly to acquire MR images; and

a computer programmed to sample spatially-encoded MR imaging data from a region-of-interest having motion therein with any given k-space trajectory to fill k-space and determine motion in the region-of-interest directly from non-spatially-encoded MR non-imaging data acquired from the MR signals as the given k-space trajectory passes through or near the k-space origin at least once every repetition interval of a pulse sequence.

2. (Original) The MRI apparatus of claim 1 wherein the computer is further programmed to:

sample the MR signals for a center of k-space at least once each repetition time before onset of spatial encoding gradients; and

determine fluctuations, if any, in at least one of magnitude and phase in the MR signals for the origin of k-space measured over time to determine motion in the region-of-interest.

3. (Original) The MRI apparatus of claim 2 wherein the computer is further programmed to process the magnitude of the MR signals for the origin of k-space as a gating signal to at least one of prospectively and retrospectively trigger a gated acquisition.

4. (Original) The MRI apparatus of claim 3 wherein the gated acquisition includes at least one of a cardiac gated acquisition and a respiratory gated acquisition.

5. (Original) The MRI apparatus of claim 2 wherein the computer is further programmed to process the magnitude of the MR signals for the center of k-space to carry out slice tracking.

6. (Original) The MRI apparatus of claim 2 wherein the computer is further programmed to process the phase of the MR signals for the origin of k-space to at least one of

prospectively and retrospectively correct phase errors in MR data acquired from the region-of-interest prior to image reconstruction.

7. (Original) The MRI apparatus of claim 2 wherein the origin of k-space includes the center of k-space and a plurality of k-space points centered about the center of k-space.

8. (Original) The MRI apparatus of claim 2 wherein computer is further programmed to determine the fluctuations from modulation of transverse magnetization in the origin of k-space measured over time.

9. (Original) The MRI apparatus of claim 1 wherein the RF coil assembly includes a phased array coil architecture having a plurality of RF coils, and wherein the computer is further programmed to sample the MR signals for an origin of k-space at least once each repetition time for each RF coil and one of:

combine data acquired by each coil to generate a combined set of data and determine fluctuations, if any, in at least one of magnitude and phase in the MR signals for the origin of k-space measured over time to determine motion in the region-of-interest from the combined set of data; or

select a coil most sensitive to motion in the region-of-interest and determine fluctuations, if any, in at least one of magnitude and phase in the MR signals for the origin of k-space measured over time to determine motion in the region-of-interest from the selected coil.

10. (Original) The MRI apparatus of claim 2 wherein the computer is further programmed to first sample the origin of k-space immediately after application of a slice selection gradient and second sample the origin of k-space after application of a rewinder gradient without a scan time penalty.

11. (Original) The MRI apparatus of claim 10 wherein the computer is further programmed to compare MR data from the first sampling of k-space with MR data from the second sampling of k-space, and determine appropriate correction of imaging data from the comparison.

12. (Original) The MRI apparatus of claim 1 having a table configured to move a subject fore and aft within the bore.

13. (Original) The MRI apparatus of claim 1 wherein the computer is further programmed to accept/reject MR data for image reconstruction based on the determined motion in the region-of-interest.

14. (Original) The MRI apparatus of claim 1 wherein the computer is further programmed to cause acquisition of MR data from a subject during non-breathold intervals.

15. (Previously Presented) A method of MR imaging comprising the steps of:

sampling MR data in each of a plurality of repetition time intervals for a central region of k-space prior to application of spatially encoding gradients in each repetition time interval, the k-space filled using a given k-space filling trajectory with MR data acquired from a region-of-interest having motion therein;

monitoring motion-induced modulation in the MR data for the central region of k-space over the plurality of repetition time intervals; and

determining motion in the region-of-interest from the motion-induced modulation in the MR data for the central region of k-space independent of the given k-space filling trajectory.

16. (Original) The method of claim 15 further comprising the step of combining MR data for the central region of k-space acquired by a plurality of RF coils of a phased array coil assembly and determining motion in the region-of-interest from the combined MR data.

17. (Original) The method of claim 15 further comprising the step of determining which RF coil of a phased array coil assembly is most sensitive to motion in the region-of-interest and using the MR data acquired by the determined RF coil for one of slice tracking, phase error correction, and data acquisition synchronization.

18. (Original) The method of claim 15 further comprising the step of determining motion in the region-of-interest from modulation in at least one of magnitude and phase of the sampled MR data.

19. (Original) The method of claim 15 further comprising the step of carrying out either a single shot or a multi-shot acquisition of MR data from the region-of-interest.

20. (Original) The method of claim 15 further comprising the step of using the determined motion in the region-of-interest to synchronize a gated acquisition of at least one of cardiac and respiratory MR data.

21. (Original) The method of claim 15 further comprising the step of simultaneously acquiring information regarding motion in the region-of-interest with respect to respiratory induced motion and cardiac induced motion via motion-induced modulation in the MR data for the central region of k-space.

22. (Original) The method of claim 15 further comprising the step of correcting image data for phase errors prior to image reconstruction using the determined motion in the region-of-interest.

23. (Original) The method of claim 15 further comprising the step of sampling MR data for the central region of k-space at least once every repetition time interval of a pulse sequence applied to image the region-of-interest.

24. (Original) The method of claim 15 further comprising the step of sampling MR data for the central region of k-space without subjecting a subject to breath-holding.

25. (Original) The method of claim 15 further comprising the step of determining motion in the region-of-interest directly from the MR data acquired from the region-of-interest without a separate acquisition of physiological motion data.

26. (Original) The method of claim 15 further comprising the step of determining motion in the region-of-interest independent of motion type.

27. (Original) The method of claim 15 wherein the central region of k-space includes a plurality of k-space points centered about an origin of k-space and further comprising

the step of sampling the plurality of k-space points at least twice per repetition time interval of an applied pulse sequence.

28. (Previously Presented) A computer readable storage medium having a computer program stored thereon to assess motion in a region-of-interest and comprising a set of instructions that when executed by a computer causes the computer to:

sample a central region of k-space each repetition time interval of a pulse sequence applied to acquire MR data from a region-of-interest;

measure modulation of MR data in the central region over several repetition time intervals;

determine motion in the region-of-interest based on differences in magnitude and phase measured in the MR data over the several repetition time intervals independent of k-space trajectory used to fill the central region of k-space; and

regulate operation of an A/D converter such that MR data is acquired for the central region of k-space prior to application of spatial encoding gradients of the pulse sequence.

29. (Canceled)

30. (Original) The computer readable storage medium of claim 28 wherein the computer is further caused to simultaneously determine and delineate between motion induced by respiratory movement and cardiac movement in the region-of-interest.

31. (Original) The computer readable storage medium of claim 28 wherein the computer is further caused to correct for phase errors in imaging data from the determined motion in the region-of-interest.

32. (Original) The computer readable storage medium of claim 28 wherein the computer is further caused to use information regarding motion in the region-of-interest to synchronize acquisition of gated MR data.

33. (Original) A method of MR imaging comprising the steps of:

acquiring a first set of non-spatially encoded MR data from a region-of-interest prior to application of spatially encoding gradients;

acquiring a second set of non-spatially encoded MR data from the region-of-interest after application of rewinder gradients; and

determining motion in the region-of-interest from the first and the second set of non-spatially encoded MR data.